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Bluefin Spawning in Central North Atlantic?

Molly Lutcavage

Historic U.S. Research Tagging and Cruises

In May 1952, when biologists Frank Mather and Howard Schuck applied the first stamped and numbered hooks to giant bluefin tuna (*Thunnus thynnus*) slamming past the island of Bimini, they had no way of knowing the impact their modest experiment would have on fisheries science. In the fall of that year, Schuck took a phone call from a Nova Scotia tuna trap owner, learning that the first of the Bimini-tagged giants with a numbered hook in its jaw had been landed. In his own words, he and Mather went "through the roof" with astonishment (Shuck, 2000). For nearly 50 years, their simple identification tag was the principal tool of bluefin research, but the migration paths of giant bluefin on the high seas remained shrouded in mystery.

The last exploratory U.S. research longline expeditions targeting tunas in the Central North Atlantic were the U.S. Bureau of Commercial Fisheries MV Delaware and Crawford cruises, spanning 1955–1963. Chief scientists included Mather and Pete Wilson, a New England fisheries biologist. The most extensive, Cruise 63-4, left Gloucester, Massachusetts, in late April and traversed 5,500 miles in 50 days, on a transect spanning the North Atlantic between Bermuda and the Madeira islands (see Fig. 1). Although most of the landed bluefin tuna were small fish taken near the U.S. continental shelf, giant bluefin were caught in early- and mid-May near the Azores. But funding for high seas research cruises evaporated, and bluefin scientists once again were forced to keep close to their home bases.

Single-Point Pop-up Tags Reveal Surprises

Beginning in 1997, in a collaboration between scientists and fishermen, our research group conducted satellite tagging of spawning-size class Atlantic bluefin tuna in New England and Canada. My collaborators included Dr. Rich Brill, NMFS Kewalo Lab, Honolulu; Dr. Julie Porter, Department of Fisheries and Oceans, Canada; Greg Skomal

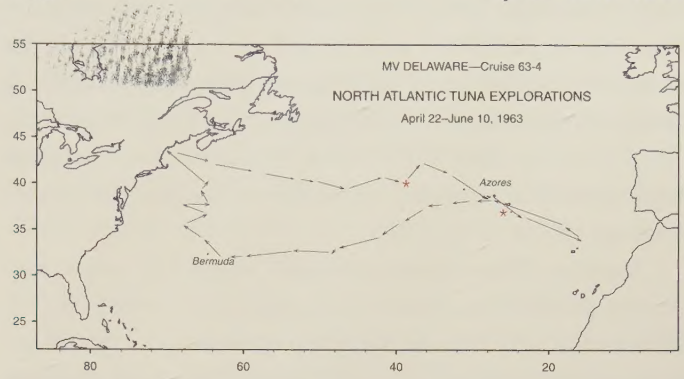

Figure 1. Research longline expedition 63-4, out of Gloucester, MA.

and Brad Chase of the Massachussets Division of Marine Fisheries; Dr. Paul Howey and Ted Rollins of Microwave Telemetry, Inc.; and U.S. tuna fishermen Cookie Murray, Bill Chaprales, Anthony Mendillo, Mike Genovese, and Bob Matthews.

The single-point pop-up tags were developed by Microwave Telemetry, Inc. (Columbia, Maryland), and successfully tested and deployed on medium-sized fish off North Carolina (Block et al. 1998); they consist of a radio transmitter, environmental sensors and a data logger that jettison from the fish after a predetermined release date. Data is relayed to orbiting satellites and distributed by Service Argos, Inc. to researchers via the internet. Our goals were to determine the long-term movements, origins and behavior of the bluefin assemblages found on the New England shelf in summer and fall. We targeted adult fish comprising spawning-size classes (>200 cm SFL) and programmed the majority of satellite tags to detach from the fish over their presumed spawning period (April to July).

Our pop-up satellite tags were, in effect, a high tech version of Mather's and Schuck's visionary fish marker, and in 1998, results from our tags were as surprising as early

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returns from the first generation hook-ID tags. From 1997 to 1999, all successfully released tags reported from the Central Atlantic roughly between Bermuda and the Azores. Each year, about 30% of tags on New England fish reported from east of the 45°-W stock-division line, and none of the giant bluefin were in or near known spawning grounds in the Gulf of Mexico or Mediterranean Sea (Lutcavage et al., 1999; 2000; see also PFRP Vol. 4, No. 1, 1999). A separate tagging study of younger fish off North Carolina had similar findings (Block et al., 1998).

Together, these consistent results suggested several surprising possibilities, all of which challenged current understanding of the Atlantic bluefin's spawning habits. Since none of the spawning-size fish tagged in the Gulf of Maine were located in either known spawning ground when their tags reported, it seemed possible that a previously unknown spawning area might exist in the Central North Atlantic. The alternative hypothesis, that bluefin tuna do not spawn annually, was also an astonishing, albeit remote, possibility.

Archival Pop-Up Tags Gather more Data

Despite consistent results from single-point pop-up tags, we realized that a third possibility remained that might explain why giant bluefin were not found in either known spawning area: the number and timing of tag releases was insufficient to detect spawning. In 1999, we deployed 21 of the newly developed pop-up archival tags (PTT-100, Microwave Telemetry, Inc.) on New England and Canadian giant bluefin for attachments of up to one year. The new tags have an expanded data-logging capacity and a light sensor. After data processing, recorded ambient light levels are used to determine day length and local noon to estimate latitude and longitude (e.g., Klimley et al. 1994; Welch et al. 1999); like implanted archival tags, they can depict the full migration path of the fish.

The pop-up archival tags we use are pressure tested to 3,300 psi, and record ambient light levels at 2 minute intervals, and temperature (± 0.2° C) and depth once an hour and at sunrise and sunset. As a fail-safe, the tag can be programmed to detach at a preset depth (e.g. 1,000 m), or when the tag stays at a user-defined constant depth for a predetermined interval. The tag transmits raw data defining temperatures, pressures and estimates of sunrise and sunset time. This data is processed by the manufacturer, and longitude and latitude estimates are generated with proprietary software; estimated errors are given as about one degree of

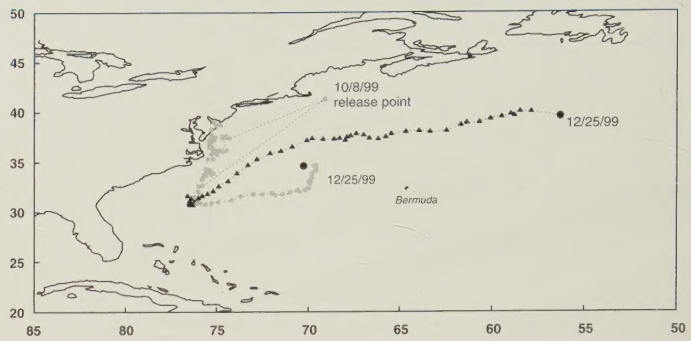

Figure 2. Estimated migration paths of two bluefin tuna released from purse seine on 8 October, 1999. Their pop-up archival tags reported on 25 December, 1999.

longitude and several degrees of latitude. Another version of a pop-up archival tag is currently manufactured by Wildlife Computers, Inc. (Redmond, Washington).

In February 2000 at the PFRP Symposium "Tagging and Tracking Marine Fish with Electronic Devices," we presented estimated migration paths from the first two pop-up satellite archival tags. The two 400-lb fish, schoolmates released from a purse seine set in October 1999, had crossed the Gulf Stream and taken similar routes to the southeast, but were thousands of miles apart when their tags jettisoned on Christmas day (see Fig. 2).

We enjoyed high reporting rates with the pop-up satellite archival tags we deployed in 1999 (17 out of 21 tags, or 81%) and now have data capable of depicting full migration paths and environmental associations (80–340 days) of 12 fish. Without exception, their migration paths overlay reporting locations of single-point tags from previous years, and stretch to the Azores, spanning the historic transect of the MV Delaware. Based on tags that remained on fish for nearly one year (September to September), it was also apparent that not all Gulf of Maine giant bluefin return annually to the New England shelf (see Fig. 3). Furthermore, migration paths deduced from pop-up archival tags showed that fish did not interrupt their residencies in the Central North Atlantic to visit either known spawning area.

New Spawning Ground Awaits Discovery?

The economic and conservation implications of possible spawning of bluefin tuna in the Central Atlantic are enormous. Since 1981, Atlantic bluefin tuna have been managed by ICCAT as two biological units separated by a management line at 45° W. The biological basis of this management division presumes separate and exclusive spawning grounds (in the Gulf of Mexico and the Mediterranean Sea), different

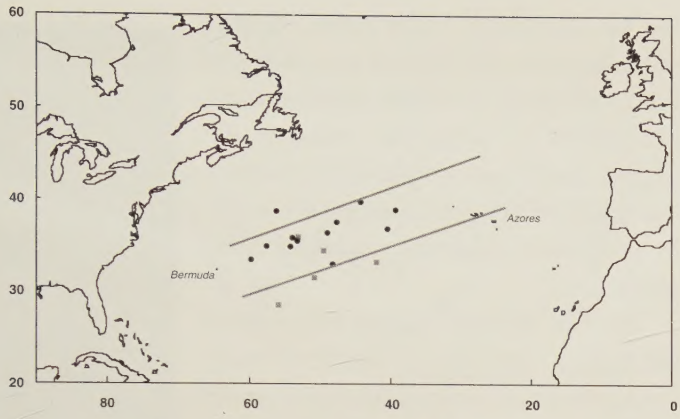

Figure 3. The area depicted by the gray lines defines the distribution of bluefin tuna (from pop-up archival tags) between May and mid-September, 2000 in relation to reporting locations of single point tags that jettisoned from giant bluefin between May and July, 1998 (black circles) and 1999 (gray squares).

ages of first reproduction, and an assumed low transfer rate (2–7% annually).

In May 2000, researchers and fishermen met in Hamilton, Bermuda to discuss the distribution and biology of giant bluefin in the Central North Atlantic (Lutcavage and Luckhurst, in press). Participants focused their attention on historic data from the MV Delaware and Crawford cruises, and the new tagging data challenged prevailing views of bluefin biology. The Bermuda working group produced a consensus document, endorsed by ICCAT in November 2000, that recommended an exploratory research cruise in 2001 to sample spawning-size bluefin tuna.

In January 2001, researchers from Canada, the U.S., Japan and Bermuda met at the New England Aquarium in Boston to plan a research longline cruise in the Central North Atlantic. Its mission, to locate and sample giant bluefin roughly between Bermuda and the Azores in summer, is a challenging one. Specific recommendations call for a multi-year study, with international participation by oceanographic research vessels and two longline vessels, and full financial support for oceanographic data collection and analysis of samples.

Management Implications—Central North Atlantic

Researchers and fisheries managers alike are faced with the thorny question: are the warm waters of the Central North Atlantic home to spawning bluefin tuna? If not, then what is the role of this poorly-studied region in the bluefin tuna's life cycle? The initial longline cruise planned for bluefin research in summer 2001 will journey to these distant regions. It carries a high risk of failure, but with luck, we may soon have the answer to these critical management questions.

Even then, the fact remains that Gulf of Maine bluefin comprise only a fraction of the combined Atlantic and Mediterranean population. High-tech satellite tags, remote sensing tools, extensive financial resources, and an expert, international scientific team will be needed to clarify the migration paths and spawning habits of this long-lived, highly migratory species.

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Luring Anglers to Research

Rich Brill

Pop-up satellite archival tags (PSATs— see Figure 1) are the latest, and to date one of the most advanced, tools used by marine scientists to study large pelagic fishes like marlin and tunas. This exciting new technology is beginning to open wide new windows on many important aspects of the migrations and behavior of these fishes.

Under the "Lure an Angler to Research" program jointly sponsored by the Hawai'i Conservation Foundation, Maui Jim Sunglasses and Caterpillar Diesel, and jointly organized by Tropdilla Productions and the National Marine Fisheries Service Honolulu Lab, PSATs were attached in July 2000 to four blue marlin and one black marlin caught off the Kona coast. The program is an ongoing cooperative effort to deploy the greatest number of PSATs possible by enlisting the aid of sportfishers, and their captains and crews, in deep-sea fishing tournaments.

PSATs— the ET's of Fish Tags

Three of the PSATs jettisoned on schedule and "phoned home" to report their data. Unfortunately two tags have not been heard from. The failure of these tags to report may be due to any of several reasons: damage to the antenna if the fish free-jumped and landed on the tag, some breakdown of the electronics or batteries within the tag, or because the tagged fish died and sank.

If a tagged fish sinks, the PSAT's float eventually will be crushed by increased water pressure, and the tag will never make it back to the surface. Because radio waves can't be transmitted through seawater, PSATs must be floating with their antennas in the air to upload their data to orbiting satellites; tags that don't surface can never phone home.

Marlin Tags Phone Home

The daily positions recorded by the tags on the black and one blue marlin are shown in Figure 2. The large circles at either end show where the fish were tagged (recorded by the fishermen) and where the PSATs popped up (recorded by the receiving satellite). Note that the locations fixed from the light-level data do not match exactly with the actual locations of the tags. This occurs because determining precisely when sunrise and sunset occurs is a very difficult thing to do underwater, especially because the fish are constantly moving up and down! As a result, latitude estimates with the current generation of PSATs are good to within approximately plus/minus 1°. Longitude estimates are slightly better (generally good to within a few tenths of a degree) because it is easier to accurately measure times of local noon.

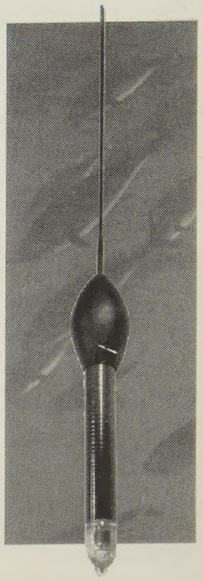

Figure 1. PSAT

The tags deployed during this phase of the project were not yet capable of measuring the fishes' swimming depths, as are the current generation of PSATs. Only water temperature data were recorded, but because temperatures get colder as fish swim deeper, the temperature record does give some idea of vertical movements. The black marlin showed behaviors that we know to be very characteristic of marlin in general (see Figure 3a). It appears the fish spent the majority of its time near the surface (shallower than about 100 m) and only occasionally ventured down into colder water, but never into water colder than about 15° C (59° F). The estimated maximum depth the fish reached was 300–400 m, and it's apparent something happened around September 13, because the temperature record suddenly became more stable. The fish may have stopped regularly swimming up and down, but a more plausible explanation is that the PSAT prematurely detached from the fish and was simply floating on the surface. The changes in temperature seen after September 13 could be due to the sun warming the transmitter and rain squalls cooling it off.

The problem of tags possibly being shed prematurely is also seen in both blue marlin temperature records (see Figure 3b). The first appears to have become detached only about six days after the fish was tagged and released (around July 26), and the second about four weeks after (around August 14). All tags were attached to the fish using large medical-grade nylon tag heads and 300-lb test fluorocarbon leader material. Why two tags apparently detached prematurely remains a mystery, as does the reason for failure of two of the five tags to report so far.

Interpreting the Data

The data we obtained do show several things very clearly. After tagging, the black marlin was alive and behaving normally for about 60 days, and the blue marlin for between

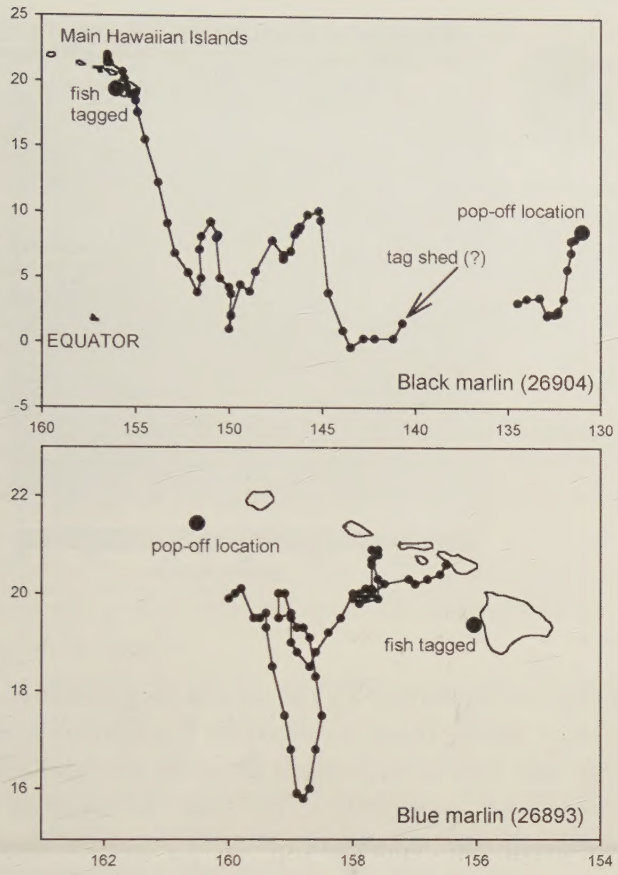

Figure 2. Daily positions of tagged marlins.

6 and 30 days. Both blue marlin appear to have stayed in the immediate vicinity of the main Hawaiian Islands. In contrast, the black marlin moved rapidly south about a week after release, eventually reaching an area only 5° north of the equator. It appears that, although the marlin was actively swimming north and south, it also was being carried along with the eastward flow of the North Equatorial Countercurrent, a rapidly flowing (greater than 1 knot) current in this area (see Figure 4).

Value of Public/Private Cooperation

Although keeping the PSATs reliably attached to marlin is a problem that has yet to be solved, the really difficult part of this kind of research is catching the fish and getting the tags on in the first place! Marlin are sometimes referred to as "rare event species" because so much time must be expended at sea to catch them and attach a PSAT. It takes a great deal of skill and effort to hook a large marlin, bring it to the boat in good condition, safely attach a PSAT, and successfully release it—and it would be almost prohibitively expensive if boat time and tournament anglers' efforts weren't freely donated. This is why cooperative efforts with private organizations are so tremendously useful. The willingness and experience of boat captains, deck hands and anglers are assets of tremendous value that literally make this project possible.

According to Jody Bright, of Tropdilla Productions, "Having Dr. Rich Brill on hand at the tournaments was interesting for the anglers and lent credibility to our efforts, as a non-profit NGO, to help pelagic fisheries research. But the most valuable aspect of the cooperative effort from our point of view is the satellite imagery produced by Dave Foley of NOAA. Those images have made it possible for the first time in history for people across the globe to take part in high tech wildlife research by just visiting a website."

The tracks are available on the Hawaii Conservation Assoc. web site at www.hawaiica.org, or at www.konatournaments.tappedinto.com.

Plans for the Future

To surmount some current problems, the next generation of PSATs will jettison from the fish, float to the surface, and begin transmitting data if tagged fish go below a specified depth (around 2000 m) at which the tags' floats would be crushed. Because a fish would only go this deep if it had died and was sinking, the latest generation of PSATs should enable us to tell if a fish died and sank.

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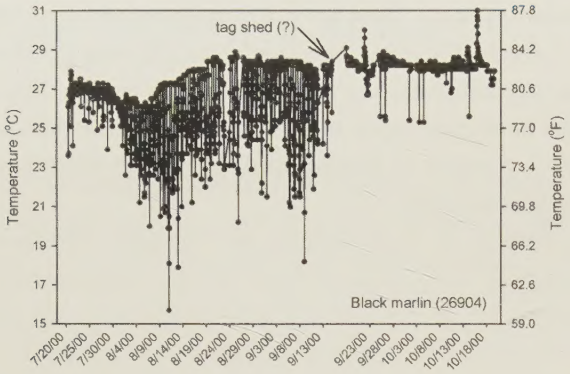
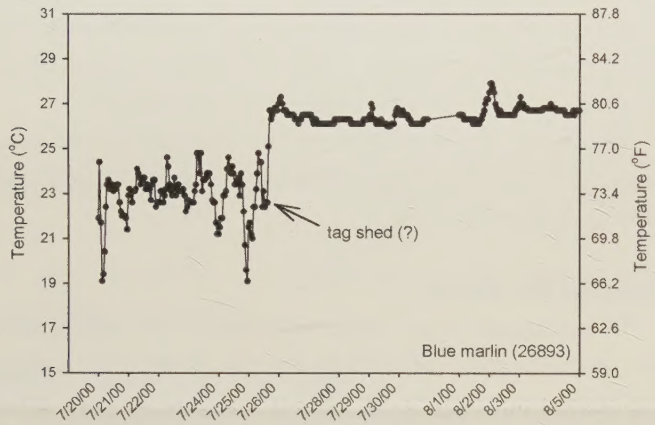
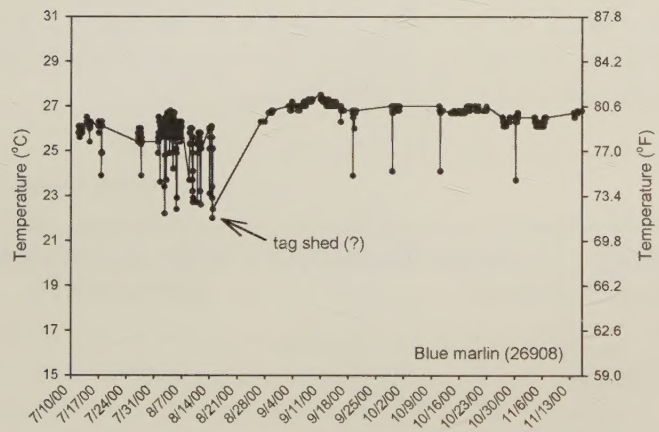


Figure 3a.





Figures 3b. (center and bottom) 3a and 3b are tagged marlin temperature records.

Still on the agenda: obtain more funding, purchase and deploy more latest-generation tags, and test different tag-head designs and materials, among other things.

Richard Brill is a Fishery Biologist with the NMFS Honolulu Laboratory. His current research focus is on the physiology, physiological ecology, and sensory biology of tunas,

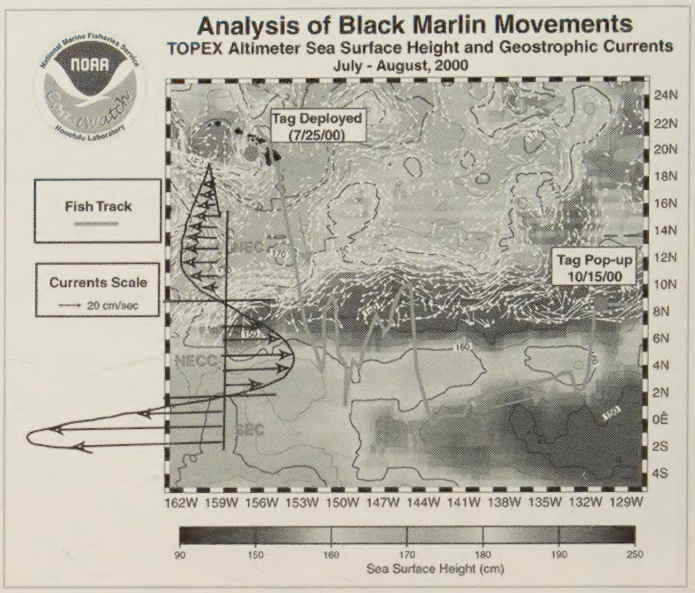

Analysis of Black Marlin Movements
TOPEX Altimeter Sea Surface Height and Geostrophic Currents
July - August, 2000
Tag Deployed (7/25/00)
Tag Pop-up 10/15/00
Fish Track
Currents Scale
20 cm/sec
NECC
NECC
SEC
162W 159W 156W 153W 150W 147W 144W 141W 138W 135W 132W 129W
24N 22N 20N 18N 16N 14N 12N 10N 8N 6N 4N 2N 0Ê 2S 4S
90 150 160 170 180 190 250
Sea Surface Height (cm)

Figure 4.

billfishes, and sea turtles. He's at sea now on a swordfish and blue shark tagging cruise, accompanied by experts in sensory biology who hope to learn more about the vision of tunas, marlins and swordfish. He can be reached at rbrill@honlab.nmfs.hawaii.edu.

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Trackmap of blue marlin 26893, with tagging and pop-up locations shown.

Pelagic Fishing in Guam—A Sociocultural Study

Donald H. Rubinstein

Research on pelagic fisheries often has overlooked a key aspect of the activity: the fishermen and women themselves. The Pelagic Fisheries Research Program (PFRP) has sought to address this gap by supporting research on fishers, and integrating this research with the more predominant research on fish. As part of this effort to expand the focus of research, and with early encouragement from Dr. Craig Severance, representing the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council, I undertook a sociocultural study of pelagic fishing in Guam. Working with me on this project were colleagues Dr. Thomas Pinhey and Stephen M. Vaughn.

In planning the project, we collaborated with Dr. Michael Hamnett at the University of Hawai'i at Manoa, Dr. Craig Severance at the University of Hawai'i at Hilo, and Dr. Robert Franco at Kapi'olani Community College, who were conducting parallel studies in American Samoa and the Commonwealth of the Northern Mariana Islands.

Methodology and Respondents

The research involved use of a seven-page structured interview augmented by observation of participants; it was designed to produce a profile of contemporary demographic and sociological characteristics of Guam's pelagic fishers, as well as their attitudes towards various fisheries management strategies. Initially, fishers were contacted at Guam's main boat ramps and harbors, at various fish markets, boat supply and tackle stores, and through contacts at the Guam Fishermen's Cooperative Association; the sample expanded as initial contacts led to new contacts. Because the population of pelagic fishers in Guam is unrecorded, and local fishers are not required to obtain a fishing license, there is no way to obtain a truly representative sample. Our sample included nearly a hundred respondents, which we believe represents the majority of pelagic fishers in Guam, and provides a very reliable profile.

Our sample reflects the sociocultural and geographic diversity of Guam, as well as the unique characteristics of the fishers as a subset of Guam's general population. The geographic distribution of our sample includes representatives from 16 of the 19 villages in Guam. The mean length of village residence for fishers is 16.8 years, indicating a fairly stable population, but the range is extreme, extending from less than one year to 69 years. Of the total sample (N=97) of respondents, all but 2 are men. This gender distribution reflects the strong cultural values in Micronesia that discourage women from involvement in pelagic fishing; significantly, neither of the two women in our sample are Pacific Islanders.

The ethnic distribution of fishers also reflects the island's distinctive cultural and economic patterns. Indigenous Chamorros account for the largest number of pelagic fishers in Guam, constituting 41% of the fishing population, which equates almost exactly with the 43% of the general population that claim Chamorro ethnicity (using 1990 Guam census data). Other Micronesians (mainly from Palau and the Federated States of Micronesia) are significantly over-represented, forming nearly 18% of the fishing population but only about 6% of the general population (based on more recent survey data from the U.S. Dept. of Interior). Guam's Euro-American population is likewise over-represented, comprising 27% of the fishing population but only about 18% of the general population. On the other hand, Asians are significantly under-represented. Filipino fishers comprise 7% of the pelagic fishing population, but nearly 23% of the general population, while other Asians (mainly Chinese and Japanese) account for 3% of the pelagic fishing population, as opposed to 13% of the general population.

The mean number of persons per household in our sample is 4.1; this corresponds closely with the mean of 4.2 persons per household in the general population (1990 census). But Guam pelagic fishers appear on average to be significantly more affluent than the general population. The median household income of fishers in our sample is $50,000, 63% greater than the island's median household income of $30,755. It is important to emphasize, however, that the population of Guam fishers is highly diverse, economically. The subset of Micronesian fishers (from the Republic of Palau and the Federated States of Micronesia) has a median household income of only $20,000, 35% less than the median household income; in addition, these fishers have a mean household size of 6.9, significantly greater than the island-wide mean of 4.2.

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Boats and Fishing Equipment

Almost three quarters (72%) of our sample of fishers are either the sole owners or co-owners of a boat, which in every case has a single hull. Most commonly used are 20-foot boats, with outboards as the engine of choice 88% of the time. Slightly more than half of the fishers have some sort of alternative power to preserve mobility in case of engine failure, including use of two primary engines, or a primary and a secondary that has 10% to 15% of the primary's horsepower.

Among the fishers, there is a very wide range of capital outlay for boats, engines and trailers. The median outlay is $13,000, which represents 26% of the fishers' median household income.

The electronic equipment most commonly owned by Guam pelagic fishers are VHF radios, depth finders and GPS, which are present on two-thirds or more of the boats. Many fishers (31%) also bring cell phones on fishing trips to serve as a backup means of communication. Only 19% of boat owners reported carrying an EPIRB (Emergency Position Indicating Radio Beacon), which are required by the U.S. Coast Guard for vessels participating in commercial fishing from Guam, but are fairly expensive.

Among fishing gear, poles and reels require the greatest capital outlay, with a range from $100 to $21,000 and a median expense of $1,500. Guam pelagic fishers generally take part in other forms of fishing, using cast nets, gill nets, spear guns and dive equipment (including scuba gear). A majority (63%) of our respondents reported owning spear guns and snorkel equipment (median capital outlay $350), but participant observation reveals that spearfishers target reef fish exclusively, not pelagic fish.

We recorded data on 340 separate fishing trips reported by 96 fishers. Many reported using more than one fishing method during a single trip, often trolling and bottom-fishing on the same outing. Trolling is the most common method of fishing, occurring on 70% of the outings.

Fishers' Perception of Current Pelagic Fishery

The great majority (81%) of our respondents indicated that trolling has become more difficult over the past five years. Responses fell into four general categories. Most (71%) believed that over-fishing is the primary cause of the increasing difficulty of catching fish by trolling in Guamanian waters. Some simply perceived a decrease in resources without a specific cause. Others pointed to overuse of fishing areas, including competition from local fishing boats and activities such as jet-skies, parasail boats, and dive boats. Several respondents attributed the increased difficulty of catching pelagic fish to climate change, including changing current and weather patterns.

In our interviews, we asked open-ended questions regarding management practices that could affect trolling in Guam waters in the future. Fishers suggested three general approaches to managing the island's pelagic resources. The first involves developing the resource further through such activities as fishing derbies, public education, market improvements, and especially the development and installation of more FADs. The second involves imposition of various restrictions, such as size limitations, area or seasonal restrictions, catch quotas, and limited entry of fishing vessels. The third approach involves aggressive monitoring and regulation, or even the ban of foreign longline and purse-seining vessels within Guam's EEZ. Our respondents indicated that local fishermen should be included in development of a preferred management strategy for both trolling (40%) and longlining (37%).

The interviews also revealed that Guam fishers are generally unfamiliar with the Western Pacific Regional Fishery Management Council (WestPac) and the National Marine Fisheries Service (NMFS). Our questions regarding longlining and purse seining also revealed some misunderstanding among Guam fishers; some were unfamiliar with the terms, while others were uncertain about the practices of these fishing methods.

Fishing Motivation, and Fish Distribution and Sale

We asked our respondents "Why do you go fishing?", and their answers revealed three motivations. The predominant motivation (65%) emphasized the personal enjoyment derived from fishing; a number of respondents within this category, especially Chamorros and other Micronesians, emphasized the sense of cultural identity they derive from fishing. A second motivation (18%) was consumption of fish for family subsistence, while the final motivation (16%) was income derived from fishing. More than half (51%) of the respondents claimed multiple motivations, and, frequently, respondents who indicated that recreation was their primary motivation also said they provided fish to family and friends.

Knowledge of fish distribution is very important to an understanding of the social and cultural significance of pelagic fishing on Guam. We asked respondents to indicate to whom they regularly give fish. Nearly all fishers (96%) reported regularly giving fish to family (36%), friends (13%), or both (47%). Most fishers (53%) said they do not give fish to people other than family and close friends; of those who do occasionally, the main recipients are church fiestas (32%) and other church events or organizations (20%). This pattern of distribution reflects Guam's long and well-entrenched Catholic tradition.

We also asked respondents if they sell fish, how often, and how much they earn from selling fish. More than half of our respondents (58%) reported that they sell portions of their catches, and their answers reveal a bimodal distribution that reflects two different motivations for selling. At the lower end of the range, fishers who sell fish one to four times per month (53%) are mostly seeking to recover some of the cost of fishing and boat ownership. At the upper end, those who sell fish eight or more times per month (36%) are more likely selling to make a profit. The median monthly earnings from fish sales are $300, and as fish are sold three times per month (median), Guam fishers are selling an average of $100 of fish per trip, or between 36 and 50 pounds of fish, according to current average market prices. The majority of fishers (69%) earn less than $500 monthly from fish sales; we have categorized these fishers as primarily recreational or subsistence fishers. A number reported that infrequent fish sales subsidize the cost of fishing equipment and boats. Finally, the 22% of fishers who earn more than $1,000 per month are primarily commercial fishers who rely heavily on fishing for their income.

Summary and Conclusions

The sociocultural and economic differences in Guam's population of pelagic fishers are somewhat representative of the diversity of the island's population. Our survey described a sample of about a hundred individuals who engage in pelagic fishing with some regularity. These respondents tended to fall into three sociocultural or demographic "types." The predominant type by far is a fairly affluent individual, typically a Chamorro or Euro-American man, who fishes several times a month mainly as a recreational pastime, and has a sizeable investment in his boat, engine, and gear. A smaller group, mostly from Palau and the Federated States of Micronesia, engages in pelagic fishing mainly as a form of subsistence, and many of these individuals have household incomes considerably below the Guamanian median. The smallest category could be considered commercial fisherman. All three categories of pelagic fishers share some perceptions about the declining health of the pelagic fishery around Guam, and the need for improved management strategies. Finally, our survey suggested that the WestPac could improve the level of knowledge about its work among Guam's pelagic fishers.

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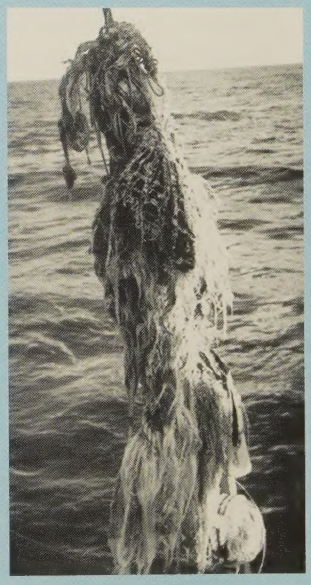

December's a la carte special at the Pelagic Research Restaurant: scientific instrument with a side of marine debris. The BIGEYE 1 oceanographic mooring was successfully recovered on December 8, 2000 by the NOAA Ship Ka'imimona, and the BIGEYE 2 mooring was deployed the following morning at 20-36.3' N 161-34.4' W.

Instrumented to measure temperature at 13 depths, current velocities at 5 depths, and dissolved oxygen and salinity at one depth, the BIGEYE 1 surfaced with a surprising amount of derelict fishing gear and other marine debris tangled around its temperature recorder, which was moored at a depth of 25 meters. It is very unusual to have this sort of accumulation of marine debris this deep.

MHLC7—Evaluation and Comment

The following Question and Answer article is the first in a series PFRP will publish over the coming year regarding the Multilateral High-level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific—or, more specifically, MHLC7—the Convention and Final Act adopted September 2, 2000 in Honolulu.

Dr. John Sibert, Director of PFRP, has the following objectives for this public discussion of MHLC7: to examine whether the scientific bodies prescribed by the Convention can adequately provide the scientific advice required to support Convention policies; to consider whether or not management policies can be administered effectively by the proposed International Commission; and to discuss the fairness of the MHLC7 convention to all involved nations, from the perspective of pelagic fisheries management.

Our goal in publishing this series is to share the evaluations of scientists and other interested persons who are well informed about MHLC7, in the hope that continued frank discussion can contribute to the most effective and mutually agreeable implementation of the convention. We have accepted the assessments of persons recommended as knowledgeable about MHLC7 and are seeking additional comment. Our principal criteria are that contributors are familiar with the proceedings, the science and the proposed management schemes, and are willing to answer the same questions, with an opportunity for open comment.

If possible, each response to an MHLC7 questionnaire sent out by PFRP will be published in the issue following its receipt. The responses are presented in Q&A format for ease of comprehension, and biographical information about each contributor is held till after his or her assessment; it is hoped this will encourage readers to consider each assessment on its merits, rather than on the basis of who provided it.

Comments, questions, and requests for inclusion as a contributor may be addressed to Editor, PFRP News, 1000 Pope Road, MSB 313, Honolulu, Hawai'i 96822, or e-mailed to andercox@aol.com.

General Questions

1. *MHLC meetings attempted to resolve international concerns and develop a formal means of managing "Highly Migratory Fish Stocks in the Western and Central Pacific." Do you feel this goal was achieved by the MHLC meetings? Why or why not?*

The goal was half achieved, but several fundamental issues still remain. On the other hand, the MHLC meetings have been a useful vehicle to make progress toward this goal.

2. *Do you feel MHLC7 was a good conclusion to these meetings? Why or why not?*

No. The final Convention so far is almost a copy of the United Nations Implementing Agreement (UNIA), which contains a lot of practical problems. These include:

- a species list that is too restrictive;
- two-fold scientific advice routes;
- obsession with Maximum Sustainable Yield (MSY) theory;
- too much detailed application of precautionary approach taken from the UNIA;
- unfair decision-making rules with regard to minor opinions, including rejection of objections; and,
- the open-seas boarding and inspection scheme.

Regarding the MHLC's two-tiered science structure, it would be better to have a single committee, but given the extensive and diverse duties defined in the Convention, the cost of the Committee will be very high, and may not be well covered by the member countries; total expenditures for a two-tiered science structure will be even greater. Therefore, I would opt in favor of each MHLC nation conducting scientific research jointly. If the scientific group encounters real difficulties or cannot reach consensus on critical issues, remedial methods can be employed, such as inviting assistance from an ad hoc independent scientific group. This approach is probably more practical.

Regarding biological reference points, MSY is not a bad concept, but always clinging to it makes things difficult when estimates are unreliable or unavailable, which is the case for several stocks in the Western and Central Pacific. What I consider appropriate when data is lacking is to use simple methods such as trend analysis of Catch per Unit Effort (CPUE), protection of juveniles, time and area closures, etc. I would also consider other alternatives to MSY that at least secure the sustainability of stocks, such as F(med) or %SPR.

3. *Should there be an MHLC8, and if so, what should be addressed at this meeting?*

Yes, to discuss major issues, especially concerns raised by

a few Asian countries such as Japan and Korea. These are mostly administrative rather than scientific matters, but some of the major points of concern for further negotiation are: the need to introduce a right of objection in the decision-making process, the requirement for open-seas inspection of boats by non-flag country inspectors, the need for more autonomy for the Northern Committee, and the degree to which MHLC copies UNIA, which has not yet been ratified by many countries.

Another subject is the name of the Convention—it is too long and the words "highly migratory species" make no sense because no one is interested in "highly migratory species" per se. Instead, it would be much more appropriate to say simply "Tunas," which denotes tunas and tuna-like fishes including ecologically related species. I cannot understand why the naming of this Convention has not yet become the hot issue. Look at the logo for the MHLC—they are tunas and billfish! This might be another example of an undesireable result from blindly copying the UNIA. The same is seen in the listing of species in this Convention—there really is no need to do so as no other international tuna management bodies do.

Specific Questions Regarding MHLC7

1. *In terms of research and data gathering, what advantages do you feel the MHLC Convention has over other conventions dealing with highly migratory fish stocks (e.g., IATTC, IOTC, ICCAT, CCSBT)?*

The Convention per se has not discussed any details of research and data gathering. Rather it simply refers to UNIA Appendices I and II, which cover many more demands than existing regional organizations. If these demands are met by member countries, there may be an advantage to the MHLC process over other organizations.

However, I am skeptical about applying UNIA Appendices I and II in the Convention area. I doubt the demands of such extensive protocols can be met, and believe we should start with practically feasible things.

2. *What are the disadvantages of the MHLC Convention with regard to data collection and research?*

I am mostly satisfied with the proposed methods of research and data collection, aside from the fact that they are too ambitious and idealistic.

3. *What do you consider to be the major obstacles facing the scientific arrangements associated with the Commission?*

The funding necessary to carry out basic scientific activities may not be secured; I have the following concerns. Compiling, updating and verifying data for member countries requires a lot of manpower, and there will be a need for help from MHLC headquarters to improve data collection for various developing countries. Therefore, given the diversity and scale of fisheries in the Convention area, we need several experts for statistics, say 3 to 4 permanent employees such as computer experts and bio-statisticians. In addition, several special scientific programs such as tagging, aging, growth and maturity studies would be necessary, and all existing regional tuna management bodies have chronic problems. The importance of these subjects can not be understated.

4. *What do you consider to be the major obstacles facing the MHLC Commission over the next few years?*

Securing budget, setting up total allowable catch (TAC) and allocation criteria for TAC will be major problems. So far, I see no practically feasible alternative better than TAC, but unfortunately, setting TAC itself is not enough to insure sustainable use of fish stocks unless we have simultaneous effort control, which is also very difficult.

5. *In the wake of MHLC7, how will management of high-seas fisheries in the Western Pacific change over the next ten years?*

More and more regulatory measures will probably be introduced, including ones for bycatch species. I am not concerned about an increase in regulation if it is fair for all countries and all fisheries sectors, but the increase will depend on how much we overshoot in our stock assessments and fisheries management plans; the fewer the overshoots, the fewer regulations we will have, which is better for anyone. It should be remembered that abuse of the precautionary approach is suicidal for all of us, and we have to be cautious not do so. Don't forget the unwarranted claim made by several irresponsible people in the past, but later refuted by scientific evidence, that large-scale drift gill net fishing adversely affected the sustainability of South Pacific albacore, north-south problem.

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MHLC7 (continued from page 11)

6. *As far as scientific research is concerned, what needs to be done during the approximately 3 years of Preparatory Conferences that take place between adoption of the text and enactment of the Convention?*

Establishment of common detailed data collection forms, data compilation/ distribution schemes, sub-groups such as statistics/species groups, and provisional estimates of TAC for major species such as yellowfin, bigeye and skipjack tunas.

7. *How will Northern Subcommittee interests be accommodated in MHLC scientific arrangements?*

The present Interim Scientific Committee should take responsibility in consultation with MHLC scientific body.

Ziro Suzuki

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Ziro Suzuki

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